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CREATION;

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OR,

THE BIBLICAL COSMOGONY IN THE LIGHT OF MODERN SCIENCE.

By JAMES D. DANA, LL.D.,

SILLIMAN PROFESSOR OF GEOLOGY AND MINERALOGY,
YALE COLLEGE.

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ARTICLE I.

CREATION; OR, THE BIBLICAL COSMOGONY IN THE LIGHT OF MODERN SCIENCE.¹

Dwight
BY JAMES D. DANA, LL.D., SILLIMAN PROFESSOR OF GEOLOGY AND
MINERALOGY, YALE COLLEGE.

THE grand history of creation with which the Bible opens is thrown into the region of myths or dreams by two classes of writers: the scientific, who know the many positive scientific errors in the accepted interpretation, and see no method of harmonizing the two diverse records; the exegetical, who hold that exegesis alone should determine the meaning of the chapter.

One such short-sighted exegete, for example, referring to Professor Guyot's recent work, seeks to enforce his various objections by such remarks as the following: "Biblical interpretation is older far than geology"! "Skill and knowledge in the physical sciences by no means necessarily involve skill and knowledge in the science of interpretation." "A man may have considerable knowledge about terminal moraines, and little or no such knowledge about the origin, history, and diction of

¹ Creation; or, the Biblical Cosmogony in the Light of Modern Science. By Arnold Guyot, LL.D., Blair Professor of Geology and Physical Geography in the College of New Jersey. pp. 140. 12mo. New York: Charles Scribner's Sons. 1884.

[For Professor Dana's former statements of his views upon this subject, see articles by him in BIBLIOTHECA SACRA, vol. xiii. (1856) pp. 80-130, 631-655, and vol. xiv. (1857) pp. 388-413, 461-525, and 854-874.—Eds.]

the New Testament books." (We stop these illustrative citations to say that Professor Guyot has no mention of "terminal moraines" in his work; and, further, he is never discourteous in language or allusion.)

"The reconciliation which it proposes between Genesis and Geology is obtained at the price of a fair and scientific exegesis." "All interpretations which depend upon reading the cosmogonic ideas of modern science into the ancient inspired record can have only the same and doubtful success." "The apparent agreement of the biblical narrative even with the geologic scheme of the author is purchased at every one of these points [the six 24-hour days, and the other usually noted discrepancies] by setting aside the claims of hermeneutical science." "No matter, therefore, how high our regard for the pious intent, the scientific attainments, and the fair, charitable spirit of the author, fidelity to the cause of biblical interpretation requires the conclusion that his attempt is a failure; and every similar attempt must end in failure."

Thus Hermeneutics, while knowing little of physical science, and apparently unaware of the antiquity of its facts, is very positive, needlessly arrogant, and self-destructive.

If the writer from whom these sentences are quoted is right in his views (see, for a full account of them, the notice of Prof. Guyot's work in the *New Englander* for July last), then "skill and knowledge in the physical sciences," *with the aid of interpretation by such an exegete*, make the account of creation a record not worth the time or labor of an exegete. Accepting the results, science becomes positive in its conclusion as to the irreconcilable discrepancies, and the falsity of any claim to inspiration, in this part of the Bible. Professor Guyot makes the remark respecting the chapter, that "its teachings are essentially of a spiritual, religious character." His critic quotes the sentence approvingly, but shears it of half its meaning. If it be true that the narrative in Genesis has no support

in natural science, it would have been better for its religious character that all the verses between the first and those on the creation of man had been omitted. There is little to encourage religious faith in the suffix "God saw that it was good," if the statement as to the work pronounced good is not in any acceptable sense true.

It is certain, in view of the facts of nature-science,—not modern facts, but facts that date far back of the science of hermeneutics and the need of it,—that the creation of the earth could not have preceded that of the sun and stars; that the creation of the sun, moon, and stars could not have taken place after the creation of plants and immediately before that of animals; that the creation of light could not, from its very nature, have taken place after that of the waters and a chaotic earth; that a solid firmament could not have existed to divide the waters from the waters; that plants, from the lower kinds up to fruit-trees, were not created in any one twenty-four hours; that, on the contrary, a vast period of time elapsed between the appearance of the first sea-plants and the first fruit-trees; that animals of the lower tribes were not created simultaneously, they having been, like plants, brought into existence successively through the lapse of geological time; that the creation of the earth and its inhabitants in any six days of twenty-four hours is inconsistent with every fact of astronomical and geological science.

Although the record in Genesis is false in all these and other points, if the interpretation of the scientific exegete from whom we have cited is correct; we believe that there is truth worth studying in the old history, which a higher style of interpretation—not narrowed down to the mere words in the document, but taking a broad view of all well-established knowledge in history, science, and language—can find and accept. We believe, with Professor Guyot, that science does already afford great help toward an understanding of this ancient inspired chapter on cos-

mogony, and that the brief review of the majestic march of events before man makes a wonderfully befitting prelude to God's message of law and love to man, constituting the Bible.

I do not mean to say that Professor Guyot's views as to the interpretation, or as to the meaning of the Hebrew words in which the oldest form of the document appears, are in every case beyond question. But I do claim for them the first place among all the interpretations that have been offered. It is now thirty-five years since Professor Guyot, two years after his arrival in America, gave me, at my house one evening, his views on the first chapter of Genesis. I listened to his interpretations of the successive verses with increasing interest to the end, and with increasing admiration and affection for the earnest, simple-minded, and learned Christian. Professor Guyot took up the subject after years of training in biblical as well as natural science, and pursued it with deep and honest searchings for the truth, believing both in the Bible and in Nature, and in the inspiration and truth of the first chapter of the Bible.

For convenience of reference I here insert

THE COSMOGONY OF GENESIS.¹

CHAP. I.—¹In the beginning God created the heaven and the earth.

²And the earth was waste and void; and darkness *was* upon the face of the deep. And the Spirit of God brooded upon the face of the waters.

³And God said, Let there be light: and there was light. ⁴And God saw the light, that *it was* good: and God divided the light from the darkness.

⁵And God called the light Day, and the darkness he called Night. And there was evening and there was morning, day first.

⁶And God said, Let there be a firmament in the midst of the waters, and let it divide the waters from the waters. ⁷And God made the firmament, and divided the waters which *were* under the firmament from the waters which *were* above the firmament: and it was so. ⁸And God called the firmament Heaven. And there was evening and there was morning, day second.

¹ The few variations from the Authorized Version have been made by Professor Wm. G. Ballantine.

⁹ And God said, Let the waters under the heaven be gathered together unto one place, and let the dry *land* appear: and it was so. ¹⁰ And God called the dry *land* Earth; and the gathering together of the waters called he Seas: and God saw that *it was* good. ¹¹ And God said, Let the earth bring forth grass, the herb yielding seed, *and* the fruit tree yielding fruit after his kind, whose seed *is* in itself, upon the earth: and it was so. ¹² And the earth brought forth grass, *and* herb yielding seed after his kind, and the tree yielding fruit, whose seed *was* in itself, after his kind: and God saw that *it was* good. ¹³ And there was evening and there was morning, day third.

¹⁴ And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and years: ¹⁵ and let them be for lights in the firmament of the heaven to give light upon the earth: and it was so. ¹⁶ And God made the two great lights; the greater light to rule the day, and the lesser light to rule the night: *he made* the stars also. ¹⁷ And God set them in the firmament of the heaven to give light upon the earth, ¹⁸ and to rule over the day and over the night, and to divide the light from the darkness: and God saw that *it was* good. ¹⁹ And there was morning and there was evening, day fourth.

²⁰ And God said, Let the waters bring forth abundantly the moving creature that hath life, and let fowl fly above the earth in the open firmament of heaven. ²¹ And God created the great sea monsters, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that *it was* good. ²² And God blessed them, saying, Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth. ²³ And there was evening and there was morning, day fifth.

²⁴ And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so. ²⁵ And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that *it was* good.

²⁶ And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. ²⁷ So God created man in his *own* image, in the image of God created he him; male and female created he them. ²⁸ And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

²⁹ And God said, Behold, I have given you every herb bearing seed, which *is* upon the face of all the earth, and every tree, in the which *is* the fruit of a tree yielding seed; to you it shall be for meat. ³⁰ And to every beast of the earth, and to every fowl of the air, and to every thing that creepeth upon the earth, wherein *there is* life, *I have given* every green herb

for meat : and it was so. ³¹ And God saw every thing that he had made, and, behold, *it was* very good. And there was evening and there was morning, day the sixth.

CHAP. II.—¹ Thus the heavens and the earth were finished, and all the host of them. ² And on the seventh day God ended his work which he had made ; and he rested on the seventh day from all his work which he had made. ³ And God blessed the seventh day, and sanctified it : because that in it he had rested from all his work which God created and made.

In the following pages I briefly review and explain Professor Guyot's interpretation, without following precisely the order in his work, adding in some parts other thoughts of his from our many conversations, where they could aid in the illustration of the subject—thoughts which, with more leisure than was afforded him in the few last weeks of his life, he would probably have brought into his volume. Where we differ on any point I make mention of it. I have also here and there added an argument in support of his views.

I. In approaching the subject we have to recognize the fact that man's comprehension of any idea communicated by another is limited by the amount and character of his knowledge and beliefs, and that the interpretation of the terms employed in the communication would be determined thereby. For example, the idea of space about the earth would necessarily take shape in the mind as that of a solid firmament with men who never had any other idea on the subject, even if the author imparting the idea were divine. The idea of fluid in space, whether liquid or gaseous, would become that of waters to those who already believed in the "waters above the heavens." (See 148th Psalm, from which Professor Guyot makes a citation.) The general expression "plants" means to ordinary men ordinary plants, such as are everywhere in view ; and only to one educated in science or philosophy are the essential attributes of a plant present in the simplest of the species. Accordingly, the terms or words by which the ideas in the Bible cosmogony are expressed must necessarily, although these ideas were divinely com-

municated, bear some impress of want of knowledge or comprehension. This important psychological fact is not referred to by Professor Guyot. My attention was drawn to it nearly thirty years since by the eminent theologian of New England, Dr. Nathaniel W. Taylor.

I suppose it to be far from certain that Moses was the inspired man who received from God the record of his creative works. It seems probable that the record was a chapter of sacred truth among men long before his time, and that it was the source of the early monotheism of the world, and of some of the cosmogonic ideas associated with this belief.

II. The brief review of creation in Genesis sets forth only the grand stages of progress in the creative work, or those great events that marked epochs in the history. Such it should have been if written by a man of supreme intelligence and exalted philosophy, and such it must be if God is the author. The number of these epochs in the account is eight. A method of interpretation that puts among the eight an event not of this epochal character should, therefore, be received with doubt.

III. System under law pervades God's works, and the discovery of it is one great end of all philosophic study of nature. Professor Guyot looked for system in the arrangement of the Mosaic record, as well as in the relations of the works themselves; and the result he reached is in itself profound testimony to its divine origin.

Of the six days of Genesis, the first three are like the last three in having *light* as the work of the first of the three days, and in having *two* great works on the last of the three. There is, thus, a parallelism in movement between the two halves, or the first and second triads. On the first day, the light was the *light* of the universe, dependent on the constitution of matter; on the fourth day, the first of the second triad, it is *light* from the sun, moon, and stars to the earth.

Further: the first triad included the events connected

with the *inorganic* history of the earth, the last of which, on the third day, was the arrangement of the lands and seas; the second triad was occupied with the events of the *organic* history, from the creation of the first animals to man.

Further: the third day, or last of the first triad, ends with the creation of plants, as its second great work, or the introduction of the new element, life, which was to be the chief feature of the progress during the succeeding era; and on the sixth day, the last of the second triad, the second great work is the creation of *man*, a being made "in the image of God," and destined through his spiritual nature to immortal progress.

This system in the divine record is not a figment of the student's fancy. It is a fact; a fact that displays purpose in the author of the document, and knowledge beyond that of ancient or any time, and philosophy more than human.

IV. The first verse of the chapter, besides proclaiming God the creator of the "heavens and the earth," teaches that the beginning of the heavens and the earth was the beginning of the existing universe. The words imply that the heavens and the earth began to exist in some state or condition; which condition, as regards the earth, was one "waste and void," or, as another translator writes it, "formless and naught."

The actual condition is partly indicated by the work of the first day, "Let light be, and light was." The light was the first light of the universe. The phenomena of light have been proved to be a result of molecular action, and to be dependent upon fundamental qualities of matter as now constituted. Man has ascertained the wave-lengths in the vibration of molecular force corresponding to light of different parts of the spectrum, and also other laws of light. He has found, moreover, that the laws of heat and of electrical and chemical action are so involved with those of light that all these conditions are convertible and

one in molecular origin. The fiat "Let light be" was, consequently, the beginning of light, heat, and electrical and chemical action in matter, which matter till then was inert; the beginning of laws of action which have since remained unchanged; the beginning of the activity which led to chemical combinations, and later to systems of worlds, to suns and to planets; the beginning, therefore, of "the Generations of the Heavens," or of the development of the universe.

The physical facts with regard to light—which, it should be noted, are not modern facts, but as old as the first creative day—thus prove to us that the "waters," upon the face of which the Spirit of God moved when the fiat of the first day went forth, were not literally waters, whatever the strict meaning of the Hebrew word; nor was "the earth" a defined sphere in space.

V. The word *day* in the chapter, with the accompanying expression, *evening and morning*, is a stumbling-block to many. The ordinary exegete finds only 24-hour days, and stands to it that the earth in its revolution was the timepiece then in use. Professor Guyot concludes from the five different uses of the word "day" in the narrative, and the fact that it is employed for three days before there was a sun to divide the day from the night (an argument which others have used), that the earth's day of twenty-four hours may not be, and cannot be, the day of Genesis; and, hence, that the days were unlimited periods—time of whatever length the work in each case required; and that the expression "evening and morning" indicates, by a familiar metaphor, the beginning and consummation of each work. If, as is now clear, the Genesis is an account of the creation of the universe, days of twenty-four hours, measured off by the revolving earth, can have no place in the history. Moreover, it is hardly possible that Moses, who wrote, "A thousand years in thy sight are but as yesterday when it is past," and, "Before the mountains were brought forth, or ever thou hadst

formed the earth and the world, even from everlasting to everlasting, thou art God," entertained so belittling an idea of the Creator and his work. Before the first day there was no literal evening; there was darkness; and then, as the Spirit of God moved upon the face of the waters, at the fiat, there was light. The succession was "evening and morning," a beginning and a consummation of the great work.

VI. The *dividing of the waters from the waters by a firmament* is the recorded work of the *second* day. The beginning of activity in matter took place on the first or preceding day; the appearance over the earth of dry land amid the gathered waters was to be the work of the third or following day. The historical event of chief importance between the two was the making of the earth.

This division of the "waters from the waters" has usually been interpreted as a separation, by an expanse or firmament, of waters of the earth's surface from the waters, that is, the clouds, above; or, of the earth's molten surface from the clouds. Such an event is too trivial for a place among the eight great works, and also is out of place on the second day. It accomplished nothing, for it left the earth under its swaddling-band of clouds. The events of the first and third days help us to understand that of the second or intervening day.

On the first day, matter was endowed with force. The next great event was the making of the universe thus begun; it was the dividing-up of this now active matter, diffused through the immensity of space; the subdividing and arranging of it, until the system of the universe had been developed, and ultimately the earth had become a defined sphere, with the "heavens of heavens," or a great expanse, around it. The words describe sufficiently well such a division of the "waters from the waters"; or, perhaps, more strictly, the final result, the earth separated from the diffused matter of space in which, on the first day, it was still involved. By the fiat, the rotation of matter in

space was begun (if this was not part of the work of the first day), and the system of the universe was carried forward. The earth, though thus defined, was still an unfinished earth.

It matters little what may be the literal meaning of the word translated "firmament." Although regarded generally among the Jews as signifying a solid firmament, it is far from certain that Moses, who was versed in all Egyptian learning, so considered it.¹ Professor Guyot quotes from verse twentieth of the narrative the expression, "fowl that may fly above the earth in the open firmament," as evidence on this point.

VII. The gathering together of the waters into one place, called seas, and, thereby, the appearing of the dry land, was the work of the *first half of the third day*. After the defining of the earth in the solar system—at first, no doubt, a liquid sphere—slow cooling and consolidation went on; and, finally, the condensation of the larger part of the enveloping vapors took place, covering the sphere with water. Still later, the waters were gathered into one place and the dry land appeared, thus determining the arrangements of the surface, and making the sphere ready for living species. With this finishing event the inorganic history of the the earth was brought to an end.

Geological readings reach back to this period of the first dry land—that of the so-called Archæan era, the geography of which era is now pretty well understood. Of the earth in its molten state the science has no facts from observed rocks, and derives its conclusions and conjectures mostly from facts and general principles in chemical and physical science.

VIII. The second fiat of the third day commences with the words, "Let the earth bring forth grass, the herb

¹ Professor Guyot places the actual defining of the earth under the work of the third day, instead of with that of the second day, as above. The order and character of the events are the same in the two methods of arrangement.

yielding seed, and the fruit-tree yielding fruit." In the expressions, "yielding seed," "having seed in itself," the words describe, with wonderful precision, as Professor Guyot observes, the characteristic of a living species, distinguishing it from mineral or inorganic substances. Beings having powers of growth and reproduction were now facts, and this was the great creation. These powers are exhibited in the simplest plants; and hence the new creation was in an important sense complete, although represented at first only by the lower tribes of plants. Obedience to the fiat, "Let the earth bring forth," continued in after time; new and higher species coming forth in succession, and ordinary fruit-trees not until the later part of geological time, long after the Coal period.

With reference to the introduction of life, science has no explanation; for no experiments have resulted in making from dead matter a living species. We can only say, "God created." The growing plant is on a higher level than that of ordinary molecular law; for it controls and subordinates to itself chemical forces, and thereby is enabled to make out of mineral matter chemical compounds and living structures which the forces without this control are incapable of. Only when growth ceases, and death consequently ensues, does ordinary chemical law regain control, and then decomposition commences. More than this, the living being, before it dies, produces germs which develop into other like forms, with like powers; and thus cycles of growth are continued indefinitely. In making its tissues, the living plant is storing force for the sustenance and purposes of beings of a still higher grade—those of the animal kingdom; beings that cannot live on mineral materials. There is, hence, reason for believing that the power which so controls and exalts chemical forces, raising them to the level required by the functions of a plant, cannot come from unaided chemical forces; and much less that which carries them to a still higher level,—that of the living, sentient animal.

In the Bible record, the creation of plants preceded that of animals; and this order is sustained by facts from nature. For the reason just stated, the plant, as Guyot says, "is the indispensable basis of all animal life." Further, the lower species of plants are capable of existing in waters hotter than animals can endure; and, therefore, the condition of the waters of the globe would have suited them very long before they were fitted for animal life; very long, because diminution in temperature must have gone on with extreme slowness.

Professor Guyot observes, further, that, since vegetation uses the animal-destroying gas, carbonic acid, as a means of growth, it served to purify the ancient waters and air, and, hence, was a befitting part of the inorganic division of the history. He also well says that the living principle fundamental to the plant was prophetic of a higher organic era beyond,—that of animal life.

Distinct remains of plants have not yet been found in Archæan rocks. These rocks have been so changed by heat that relics of plants would have been obliterated or obscured, had they existed. Some of the rocks contain great quantities of graphite, or black lead, a variety of carbon that in some cases (as in Carboniferous slates in Rhode Island, and at Worcester, Mass.) has resulted from the action of heat on coal beds. The graphite which is common in the Archæan rocks of Canada is regarded by many as evidence that Archæan time had marine plants in great abundance.

IX. On the *fourth day*, "God said, Let there be lights in the firmament of heaven." In a subsequent sentence, the words are: "made the two great lights," "the stars also." But the purpose of the lights is set forth in detail in each of the five verses relating to the day's work: "to divide the day from the night"; to be "for signs, and for seasons, and for days, and years"; "to give light upon the earth"; "to rule over the day, and over the night"; "to divide the light from the darkness"; "the greater light

to rule the day, and the lesser light to rule the night." The great purpose of the sources of light was, therefore, accomplished by them, whether they were "made" or made to appear. It was fully accomplished when the sun became to the earth the actual source of day and night and seasons, and that would have been when it first shone through the earth's long-existing envelope of clouds. Professor Guyot speaks of this envelope as consisting of electrically lighted vapor, and calls it a photosphere, resembling, in some respects, that now about the sun; and he observes that the sun, moon, and stars became visible only after its disappearance. The modern "Aurora" is a result of electric disturbances over the present cold sphere; and there can be no doubt of the vastly greater intensity of such disturbances during the period of the earth's cooling. But, whatever the fact as to the electric light about the earth when the temperature had greatly diminished, there is no doubt that the envelope of clouds was of long continuance, and that the time was slowly but finally reached when the earth was free from it. One of the sublimest passages in literature is the reference to the work of the third day in creation, contained in God's answer to Job "out of the whirlwind" (chapter xxxviii.); and, although often quoted, it may well be introduced here: "Who shut up the sea with doors?" "When I made the cloud the garment thereof, and thick darkness a swaddling-band for it, and established my decree upon it, and set bars and doors, and said, Hitherto shalt thou come, but no further, and here shall thy proud waves be stayed." The final disappearance of that swaddling-band would necessarily have resulted in the events of the fourth day.

This first appearance of the sun naturally comes after the creation of plants; for the cloud envelope would have continued long after the earth's temperature had diminished to that degree which admitted of the growth of the lower plants. And, besides, it is a natural prelude

to the organic era, the sun's light being essential to all higher grades of animal species, though not to the lower.

X. The *fiat of the fifth day* reads: "Let the waters bring forth abundantly." The words which follow describe the lower orders of animals, or the Invertebrates, together with all Vertebrates excepting Mammals (or quadrupeds and man). The *fiat of the first half of the sixth day* begins with "Let the earth bring forth," and the words that follow describe the Mammals, the division of Vertebrates of which Man is the head.

The succession in the living tribes given in the chapter is: (1.) Plants (third day); (2.) Invertebrates and the lower Vertebrates (fifth day); (3.) Mammals, or the higher Vertebrates (first half of the sixth day); (4.) Man, the head of Mammals (second half of the sixth day). This course of progress accords in a general way with the readings of science, and the accordance is exact with the succession made out for the earliest species of these grand divisions, if we except the division of birds about which there is doubt. Geology has ascertained many details with regard to the earth's life and the upward gradations in the various tribes. But the grand fact of progress, and the general order in the succession, were first announced in the Cosmogony of the Bible.

Science might say that the principles of zoölogical classification would have been conformed to more closely if the work of the fifth day had ended with the Invertebrates, leaving all the Vertebrates to the sixth day. But this arrangement, viewed in the light of the philosophy of history, is no improvement; since the record, like the rest of the Bible, has special reference to Man, in whom is the consummation of all history. The sixth day's work includes only that particular division of Vertebrates, to which Man himself belongs, whose common characteristic, that of suckling their young, is, through the feelings of subjection, reverence and affection it occasions, of the highest value as a means of binding child to parent, man to man, and man to his Maker.

XI. The various species mentioned as the work of the fifth day, and again those of the sixth day, came forth not as a motley assemblage simultaneously at the word of command, but, as already remarked, in long succession. Guyot, like his friend Agassiz, saw in the facts connected with this long succession, and in those exhibited by living species, evidence of a development, or gradual unfolding, of the kingdoms of life. He found this evidence in the general rise in grade of species from the simple beginnings of early time to the crowning species, Man. He found it, further, in the many examples of two or three lines of species divaricating off from so-called *comprehensive* or *composite* types, like the forkings from a single stem. Agassiz called the types at the head or source of such forkings *synthetic* types; and Guyot (objecting to the term "synthetic" because it implies a putting together of what was previously separate) denominated them *undivided* types, or types that were to be divided in the course of future progress. He found, following his friend, still more striking evidence of development in Agassiz's discovery that a very close parallelism existed, in numerous cases through all departments of living species, between the successive kinds of life in the geological series and the successive forms in the stages of development of single living species, so that the successive adult forms of the young (or early) world were like the successive young forms in the development of a living species. For example, in Crustaceans, or the group to which the Crab, Lobster, and Shrimp belong, the species of early time are very much like the younger stages of some of these modern species. Thus there was a degree of parallelism between the development of the long succession of species and development from the germ of a single high grade species of later time. No principle worked out by his studies called forth from Agassiz greater enthusiasm and eloquence than this last; and none led him so positively to the belief that, in his searchings and discoveries of law and system in nature, he was studying "the

thoughts of God," or, in the words of Guyot, "the will or purpose of God." The principle is now universally recognized among biologists, and has become a means of reading the past. To the ordinary eye the coiled shell of a Nautilus or Ammonite is a shell more or less smooth and pretty, large or small. To one who has learned to read nature, as has been pointed out by Hyatt, it is an historical roll: the inner coil, simple in form, being the shell of the youngest stage in its development; the successive coils, of varying form and adornment, that of the successive stages, one after another, toward the adult stage. And, further, the first stage reveals much as to the early forms in the geological history of the type, and the following, of later forms in the chronological succession. This is an example under the principle of parallelism between the stages of embryonic development and the stages in the earth's life-development.

To the minds of Agassiz and Guyot, thus taught by nature,—and to that also of the writer,—the hand of God did not appear to be lifted from his works by such truths. They held that the development was carried forward by the Creator, and looked upon each successive species as existing by his creating act. God was not only at the head as the source of power, but also in every movement, and *creatively* in each new step of progress. And how much more God-like is such a system of development than the making of the fifth-day motley assemblage of life at the spoken word!

The very words in the first chapter of Genesis, as Guyot observes, sustain this interpretation. Nowhere is there taught that abrupt creation of species which prejudging exegesis so generally finds. The narrative reads, with reference to plants, "Let the earth bring forth"; not let certain kinds, or all kinds, of plants exist; but "Let the earth bring forth"; and the creation begun in the fiat on the third day was continued on afterward, through the earth's period of growth and development. So, again,

with regard to the lower animals, with fishes, reptiles, and flying things, it says "Let the waters bring forth," instituting thus a course of development, and not fixing its limits; and conforming in the command "Let the waters" to the geological fact that the earliest animal species were all of the waters, and a great part of those that followed these throughout Paleozoic time. Further, on the sixth day, it reads, "Let the earth bring forth," although the species were of the highest class of the animal kingdom,—that of Mammals.

Gradual development is thus the doctrine of the chapter, as it is of nature. Modern science teaches what the Bible, in its opening chapter on cosmogony, first taught. Agassiz believed it; and still he was, to the end of his life, a believer, also, in the creation of each species by a divine act.

XII. Does the chapter on cosmogony in the Bible teach *the direct creation of each species by a divine act*? We look in vain for any definite statement on this important subject in connection with the works of the third, fifth, or sixth days, with the exception of the work of the latter half of the sixth day, the creation of Man. The expressions "Let the waters bring forth," "Let the earth bring forth," and the following expression, "God made," do not imply that a divine act was required for each species: they teach definitely that, man excepted, only three fiats were required for all the various and immensely numerous species that have existed in past time. And in this feature the first chapter of Genesis is like the rest of the Bible.

The question is thus left an open one, to be decided, if decided at all, by the study of existing life and that of the past. Considering, then, that the fact is not decided by the Bible, and in view of the readings of nature that have been made of late years by many investigators, Professor Guyot admits in his recent work that the question remains open. He observes that the use of the Hebrew

word *bārā*, translated *created*, on three occasions, and three only, in the chapter,—the first at the creation of matter, the second at the creation of animal life, and the third at the creation of Man,—teaches that these events were distinct creations, that is, demanded divine intervention; and that evolution from matter into life, from animal life into the spiritual life of man, is impossible; but adds with reference to the rest of the work of creation, “the question of evolution of matter into various forms of matter; of life, into the various forms of life, and of mankind into all its varieties, remains still open.”

This was not the early view of Professor Guyot nor that of the writer. It was slowly reached by us both; and only after an accumulation of facts by science—with regard to the wide varieties of existing species, the relations of varieties to physical conditions over the globe and the consequent gradations of forms, and the gradations of existing species in some cases into those of the preceding geological age, together with other paleontological discoveries—had made the argument for the development or unfolding of the systems of life, before held, an argument for development through some natural method under “the constant and indispensable supervision of God over the work.” We both hold that this natural method is at present only very imperfectly understood, and may always be so.

The idea of gradual development pervades the Mosaic narrative from beginning to end. The creation of light is not the creation of an elemental substance or property, but the imparting of forces to the particles of matter and thus initiating change and progress. The dividing of the “waters from the waters” was not the creation of any particular substance or condition, but the carrying forward of the development of the universe by movements of rotation and systems of divisions and combinations, under the law of gravitation and other molecular laws, until suns and worlds had been evolved, and, among

the worlds, the Earth. The gathering of the waters into one place and the appearing of the dry land was not the sudden creation of dry land, but a further carrying on of changes until the molten earth had become covered with the condensed waters, and had at last its seas and continents: not its finished continents, for the fiat is simply a beginning of work that was to be completed, as in other cases, in future ages.

Thus the inorganic history in the narrative is like the organic. If Professor Guyot accepts of the nebular theory in his system it is because the early part of the chapter not only is unintelligible without it, but actually teaches it. Thus science explains and illumines the inspired narrative, and exalts our conceptions of the grand events announced. Thus, also, the sacred record manifests its divine origin in its concordance with the latest readings of nature.

XIII. Of the last work, the sacred record says, "God created Man in his own image, in the image of God created he him." Three times this strong affirmation is repeated in the announcement, and three times "the potent word" *bārā* is used. Man's commission, as sent forth, was "subdue" "and have dominion," in which all nature was placed at his feet; and being made in the image of God, he was capable of moral distinctions and of spiritual progress. He was thus above nature, while of nature. "With him begins the age of moral freedom and responsibility, that of the historical world."

Science has made no real progress toward proving that the divine act was not required for the creation of Man. No remains of ancient man have been found that are of lower grade than the lowest of existing tribes; none that show any less of the erect posture and of other characteristics of the exalted species.

XIV. The words closing the verses on the sixth day are; "Thus the heavens and the earth were finished, and all the host of them." The chapter opens with the words,

"In the beginning God created the heavens and the earth;" and this verse announces the finishing of "the heavens and the earth," a comprehensive expression which throws light on the meaning of the first announcement and of those which follow it.

XV. "Now begins the seventh day, the day of rest, or the sabbath of the earth"—the day now in progress which has not yet reached its evening, in which God's "work is one of love to man, the redemption;" the creation of "the new man, born anew of the Spirit, in the heart of the natural man."

Parallel with the week of Creation, Man, a being of a few short years, has his week; and, by God's appointment, as well as Nature's need, his seventh day of rest—"of rest from daily toil, but of activity in the higher world of the spirit."

"Such is the grand cosmogonic week described by Moses," says Guyot in his concluding remarks. I have found, as years have passed since that conversation in August, 1850, no reason to change my estimate of Professor Guyot's exposition of Genesis, unless it be that I give it, with small exceptions, fuller concurrence, and find higher satisfaction in its teachings. Every feature in it, its spirit, its philosophy, its sufficiency as an interpretation of the sacred text, its consistency with the demands of science, commends it.

The appeal to nature-science which has here been made in order to sustain an interpretation of a chapter in the Bible will be to the scientific exegete—or rather to some such—another profane effort, though "of pious intent," to set aside the claims of "the science of hermeneutics," calling for another "warning of the readers of this noble little volume"—to which will now be added "the excellent BIBLIOTHECA SACRA." But this way of warning the world against the mistakes of science, without knowing the difference between its truths and errors, is an unrighteous course. It is unrighteous, because its

charges are ignorantly made; and also because what there is of truth in science is truth from a divine source, as strictly so as that of the Bible; and, thirdly, because it does harm to the cause of truth and not good.

To aid the reader in studying up science enough to make himself a judge of the scientific facts fundamental to the interpretations, I here give a brief review of these facts.

1. For the law as to the basis of light, see any text-book on Physics. The existence of the ether in space is a fact now experimentally established. Not only have the wave-lengths for the different parts of the spectrum been determined with great accuracy, but also octaves in the wave-lengths corresponding to octaves in sound-vibrations; for, although the luminous part of the solar spectrum embraces a little less than one octave, the spectrum has been studied for about four octaves beyond the red end, and one beyond the violet.

2. The melted condition of the earth when first a sphere in space is not doubted by geologists, all geological and astronomical facts favoring the conclusion.

3. The temperature at the earth's surface when molten was above 2,000° Fahrenheit, as proved by the fusing temperature of rocks. As a consequence, the ocean's waters, equivalent in volume to a layer of water 2,000 feet deep over the whole earth's surface, were then in a state of dense vapor about the sphere; and so was all else of the surface material that was vaporizable at that temperature. Since a cubic inch of water makes, under ordinary pressure and temperature, a cubic foot of steam, the envelope of vapor, atmosphere, and other gases was of great thickness and density. The water-vapor began to condense at a temperature above the ordinary boiling point, because, as experiment has shown, this temperature varies with pressure; and under the heavy pressure of the superincumbent ocean of vapors and atmosphere, the temperature at which the ocean would have begun to be made from the deposition of water, would have been, according to one estimate, 600° Fahrenheit.

4. Rapid evaporation goes on not only at the boiling temperature, but also at temperatures much below it. While hot, the clouds must have made a continuous envelope about the sphere, which cooling would finally have broken up and removed.

5. Plants live on mineral matter, and animals not—a fact well established; and hence the animal kingdom is dependent on the vegetable kingdom for its existence.

6. Plants of the lower tribes survive in waters whose temperature is as high as 200° Fahrenheit, and some are not destroyed at a temperature of 220° Fahrenheit.

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7. The question as to a genetic relation between the lowest animals and lowest plants is not yet positively decided by observation; for some biologists hold that the two kingdoms graduate into one another through intermediate species; and that although the lowest plants may have long preceded the lowest animals, the latter were a gradual development from the former. This is far from proved. The grand distinctive fact, that animals are self-conscious, or conscious of the outer world, know, avoid obstacles in locomotion, is strikingly true of the lower of the simple Rhizopods, which are species of the lowest division of the animal kingdom, as is well shown by Leidy. The claim is made only for the very lowest of this low group, which are yet doubtful things.¹

8. The first dry land of the globe appeared in what is called by geologists, The Archæan era. The position of the part over the American Continent is well known, and these positions indicate the form and location of the finished continent. Mountains existed over them, and among these oldest mountains of the oldest dry land are the Adirondacks, and the Highlands of New Jersey. The best part of the evidence with regard to the existence of plants in this era is stated on page 213. The existence of the lower of animal species during the later part of the era is yet unproved.

9. Aquatic invertebrate animals were the earliest of animal species, according to the testimony from fossils in the earth's rocks. Fishes come next in order; then Amphibians; then Reptiles. All these tribes were represented by species before the earliest of Mammals appeared. The existence of Birds before the earliest Mammals is not proved, though believed by some paleontologists on probable evidence. The early Mammals were Marsupials (like the Opossum and Kangaroo) and lived in the era called by Agassiz "The Age of Reptiles." True Mammals came into geological history in the Tertiary era, very long after the appearance of the first Birds, and they so far characterize the era that Agassiz called it "The Age of Mammals.

Man was the last of the series. It is not established that his bones or relics occur as far back as the Tertiary era.

10. The facts with regard to system, development-like, in the order of succession in the plants and animals of geological history are not doubted by

¹ Dr. Leidy says, in his large, finely illustrated work on the Fresh-water Rhizopods of North America (1879), after alluding to the absence of a mouth and stomach: "Without trace of nerve elements and without definite fixed organs of any kind, internal or external, the Rhizopod—simplest of all animals, a mere jelly speck—moves about with the apparent purposes of more complex creatures. It selects and swallows its appropriate food, digests it and rejects the insoluble remains. It grows and reproduces its kind. It evolves a wonderful variety of distinctive forms, often of the utmost beauty; and indeed it altogether exhibits such marvelous attributes that one is led to ask the question, In what consists the superiority of animals usually regarded as much higher in the scale of life?"

any geologist or naturalist. Whether the development went forward without divine intervention for each species, in accordance with some theory of evolution, is a question about which there is disagreement.

No other facts from geology or the other nature-sciences are fundamental to the explanation, though all that are known may be used in its illustration. Geologists differ as to the present condition of the earth's interior; yet would not do this long if they could get down there for a look; the fact whether now liquid or not has nothing to do with the interpretation of Genesis. They differ as to theories of mountain-making; but opinions on this point do not affect the interpretation. And so it is with other unsettled points in geology; they have no fundamental bearing on the interpretation of the first chapter of Genesis.

Geologists vary much as to their views on this chapter; and some will take it literally, affirming that it is a mere fable, no better than other fables in ancient history. We would ask of all such (as well as of the nature-doubting exegete) a reconsideration of the question; and if they have doubts with regard to the authenticity of the Bible itself, they may perhaps be led, after a fair examination of the narrative, and a consideration of the coincidences between its history and the history of the earth derived from nature, to acknowledge a divine origin for both; and to recognize the fact that in this Introductory chapter its Divine author gives the fullest endorsement of the Book which is so prefaced. It is his own inscription on the Title Page.



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